Biological Control of the Glassy-winged Sharpshooter

Monthly Report, August 2002

Gonatocerus fasciatus ovipositing on GWSS eggs.

Colonies of *Gonatocerus fasciatus* have now been initiated at UC Riverside, Mount Rubidoux, and Oswell Street. This species was released from quarantine in July and is a significant early season parasitoid of GWSS in Louisiana. The first observation that we have made in cultures is that they are competitively inferior to other Mymarid species being produced to target sharpshooter eggs. This may explain why they all but disappear once *Gonatocerus ashmeadi* builds up numbers in Louisiana. The advantage this insect does have over other species is its gregarious life history; between three and seven wasps emerge from each sharpshooter egg compared to just one for other species. This allows populations of *G. fasciatus* to build up rapidly when host egg densities are low.

GWSS EGG PRODUCTION

There have been considerable differences in the number of GWSS eggs produced by the Oswell, Rubidoux, and Buena insectaries over the past month. Three factors are responsible for these differences: methodology, locality, and space. Field collection or colonies can be used to obtain GWSS eggs for wasp cultures. The benefit of the field collection method is that all sharpshooter-allocated space is given over to oviposition or “egging” cages with adult GWSS. The drawback to this method is that field production depends wholly upon the physiological status of GWSS in the field: if the insects are not laying eggs in the field, it is unlikely that they will lay eggs in the laboratory without several weeks of conditioning. All facilities use this production method. Buena Biosystems and Mount Rubidoux are completely reliant on this strategy.

Oswell Street has invested considerable time and effort in setting up colonies of GWSS in the laboratory that are independent of field populations. While more space is needed to hold the non-egg producing stages of GWSS and their host plants, it allows the facility to produce eggs out of season. It is also a useful strategy in areas where field populations of GWSS are scarce. Continued culture of GWSS isolated from the field may also lead to the formation of laboratory populations that are easier to rear. Much of the technology that has allowed us to rear GWSS has come from work undertaken by USDA-APHIS in Mission, Texas. Mount Rubidoux is not currently rearing GWSS due to space constraints. Over the past month production has declined at Oswell Street from a mean of 10,000 eggs per week to 6,000 per week. This was largely due to restocking colony cages rather than any changes in ovipositional behavior of field collected GWSS.

Discrepancies in GWSS egg production at different sites may also be due to climatic differences and their impact on GWSS. GWSS collected in Ventura for Buena Biosystems have developed in a milder climate than GWSS in Kern or Riverside. Consequently, GWSS generation time at Buena Biosystems is longer and egg production periods are delayed. Buena Biosystems produced fewer than 2,000 eggs over the past two weeks compared with 15,000 eggs for Mount Rubidoux. Even colonies isolated from the field may show effects due to the locality from which they were collected. Recent studies by Jesus de Leon at Weslaco, Texas (USDA-ARS) have found populations of GWSS at Riverside and Kern to be genetically distinct.

BIOLOGICAL CONTROL AGENT PRODUCTION AND RELEASE

The production and release of GWSS natural enemies has continued throughout August with almost 60,000 wasps released into 8 counties in California (Table 1). Releases of the new parasitoid, *Gonatocerus fasciatus*, will commence in the following month. Locations at Imperial County were visited but no GWSS eggs were found outside insecticide treated areas, so no releases were made.

Rearing Facility	Species released			TOTAL	County
	G. ashmeadi	*G. morrilli*	*G. triguttatus*		
Oswell Street	0	0	17570	17,570	Kern
Oswell Street	0	0	14500	14,500	Ventura
Oswell Street	1,000	0	1000	2,000	Santa Clara
Mount Rubidoux	599	790	2991	4,380	Los Angeles
Mount Rubidoux	334	64	1738	2,136	Orange
Mount Rubidoux	1468	872	7412	9,752	Riverside
Mount Rubidoux	250	468	3271	3,989	San Bernardino
Mount Rubidoux	673	162	4446	5,281	San Diego
Total for August 2002	**4,324**	**2,356**	**52,928**	**59,608**	All Counties
Total for all of 2002	**31,636**	**13,229**	**205,371**	**249,670**	All Counties
Total since inception	**58,436**	**13,984**	**316,946**	**389,366**	All Counties

Table 1: Releases of GWSS egg parasitoids into California. August 2002.

Thanks to the different methods being used to obtain eggs, wasp production and release rates have been constant throughout the growing season compared to last year's production (Fig. 1).

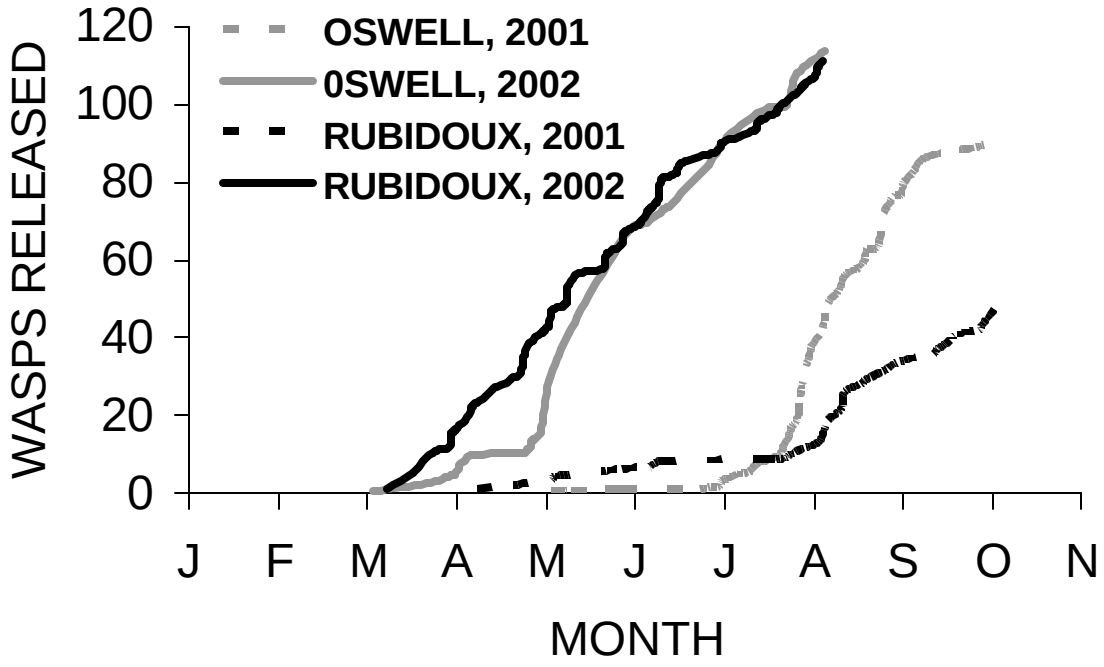

Figure 1: Release rates of GWSS natural enemies by rearing facilities in 2001 and 2002.

BIOLOGICAL CONTROL AGENT MONITORING AND RECOVERY

Sites where repeated releases are being made have been inspected for parasitism rates at regular intervals. At present, we have recovered *Gonatocerus triguttatus* from 10 locations. At six of these sites we have recovered the species more than once (Table 2).

COUNTY	SITE	RECOVERIES
LOS ANGELES	ACAP1	2
LOS ANGELES	AHUN1	2
SAN DIEGO	DPAU1	1
ORANGE	OSJC1	2
RIVERSIDE	RGIV1	1
RIVERSIDE	RTEM1	16
RIVERSIDE	RUCR1	3
VENTURA	VBART	1
VENTURA	VNEWH1	1
VENTURA	VPAC1	2
TOTAL	10	31

Table 2: Recoveries of *G. triguttatus* from release sites. Updated August 2002

RECENT EVENTS

On 15-16 August, 2002, CDFA PDP Biocontrol staff presented a poster at the Third California Biological Control Conference, held at UC Davis. The poster, titled "Glassy-winged Sharpshooter Biological Control in California - Building a Framework for Active Adaptive Management," was co-authored by Drs. Morgan (CDFA), Simmons (USDA-APHIS), Shea (Penn State University), and Ms. Higgins (CDFA). The poster described progress in our efforts to introduce GWSS natural enemies and techniques for evaluating optimal release strategies while carrying out effective management practices. An abstract of the poster is appended at the end of this report.

RELEASE TRIALS

As a part of our goal to optimize biological control efficiency, Dr. Simmons has been carrying out field-cage experiments, releasing individual and combinations of natural enemy species into enclosed areas containing GWSS eggs. This is being done to test reproduction of parasitoids under field conditions. The treatments were releases of *G. ashmeadi*, *G. triguttatus*, *G. morrilli*, or a combination of the first two species, into sleeved citrus branches with GWSS eggs. Each sleeved colony was left to run until the F3 generation to see whether these species can survive and reproduce under Central Valley summer conditions. The first experiment indicated *G. ashmeadi* had the highest egg output when reared on its own but had about equal numbers of progeny when reared in competition with *G. triguttatus*. *G.morrilli* had the lowest number of F1 progeny.

COLLABORATION

Dr. Simmons has started collaboration with Dr. Michael McGuire of USDA-ARS supporting his GWSS fungal pathogen studies with small (but stable) supplies of lab-reared GWSS. He is also supplying Allen Cohen with GWSS eggs from the lab colony to help get his colonies up and running for work on the artificial diet.

The GWSS program has begun collaboration with Dr. Doug Pfeiffer from Virginia Tech, who has just started working on a recent Pierce's disease outbreak in southern Virginia vineyards. To date, they have not found any GWSS but other sharpshooter species are implicated in the outbreak.

Because we are trying to import new species/strains of sharpshooter parasitoids that may be more active in the early spring than our natives, we are interested in surveying Virginia and the eastern coast for sharpshooter parasitoids. Working with Dr. Pfeiffer, we hope to identify good areas to search and perhaps arrange for shipments of parasitoids.

Abstract from a poster presented by the CDFA at the Third California Conference on Biological Control, 15-16 August, 2002.

Glassy-winged Sharpshooter Biological Control in California: Building a Framework for Active Adaptive Management (AAM)

Over the past year, we have made considerable advances in constructing a rigid framework in which to apply AAM. Efforts have been concentrated largely on the exploration for and screening of GWSS natural enemies, development of production techniques, identification of release sites, and the instigation of effective monitoring protocols. Releases of three species of egg parasitoids at multiple sites and their consequential recovery have allowed us to evaluate the introduction process prior to the initiation of AAM. We have also identified variables that we will be evaluating as a part of AAM, namely release numbers, frequency (spatial and temporal), and species composition.

As AAM brings a statistical approach to biological control strategies, a number of prerequisites are essential. Primary amongst these is replication. Learning is only adaptive if a control strategy is to be repeated. In general, the greater the replication, the greater the reliability of experimental findings. Some confounding effects are inevitable in this control strategy, especially questions of temporal and spatial pseudoreplication. While problems such as these can be minimized, for instance by locating treatments close to each other, they cannot be altogether removed.

Forward planning is required to fit experiments within an AAM structure. The foremost aim of this (and any other) biological control strategy is to optimize control, so any treatment that can be expected to reduce biological control efficacy should not be attempted.

Major factors that may complicate the adoption of AAM strategies include strong fluctuations in host density and native parasitoid fauna. These factors are measured as a part of the monitoring procedure and taken into account as covariates in experimental analyses. Due to the scale of the area covered (50,000 square miles) spatial and temporal differences can be considerable as a consequence of climate, agricultural practices, and geological features. Rather than attempting to correct for these differences, we will confine conclusions from experiments to the biotic and abiotic ranges in which they were evaluated.